



George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

ED27-ACU-FOP-008
Baseline
3/27/00

FACILITY OPERATING PROCEDURE

**ED27 / Vibration, Acoustics, and
Shock Team**

ACOUSTIC DATA ACQUISITION

**CHECK THE MASTER LIST—
VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE**

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Status (Baseline / Revision / Canceled)	Document Revision	Document Date	Description

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this procedure is to define the steps necessary to acquire acoustic data for sound power testing.

1.2 Scope

This document contains the procedure to be used by ED27 personnel in the course of acoustic tests.

2.0 SAFETY

2.1 Emergency Telephone Numbers

Emergency number for Fire or Ambulance - 911
Security - 544-4357

2.2 Safety Considerations

There are no steps in this procedure with special safety considerations.

3.0 APPLICABLE AND REFERENCE DOCUMENTS

3.1 Applicable Documents

None

3.2 Reference Documents

ED27-OWI-003, Test Operation Procedure Preparation and Change Control

4.0 Sound Power Testing using the Pulse System

4.1 Pulse Preparation

4.1.1 **Start the Pulse software**

Double click the Pulse icon

4.1.2 **Open the generic sound power project.**

Open the file 'F:\Generic Sound Power.pls'

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File -> Open

4.1.3 Save the project under a new name.

Save the file in the 'C:\Data\' directory with the test name.

File -> Save As

4.1.4 Verify that the hardware is responding.

Open the Configuration Organiser window.

Click the Toggle Configuration button, Organiser -> Configuration, or
Ctrl 1

All 4 boards should have a corresponding heading in the menu.

Close the Configuration Organiser window.

4.1.5 Verify the Autospectrum signal functions.

Open the Function Organizer window.

Click the Toggle Function button, Organiser -> Function, or Ctrl 3

Verify that the menu shows Autospectrum for signals 1-10.

Close the Function Organizer window.

4.1.6 Open the Measurement Organiser window.

Click the Toggle Measurement button, Organiser -> Measurement, or Ctrl 2

4.1.7 Verify that the Groups and Signals are all present under the Frontend

In the Measurement Organiser window,

Expand Frontend, Expand Signals

Should show 12 signals

Expand Groups

Should show

Group 1 with signals 1-5

Group 2 with signals 6-10

Group 3 with signal 11

Collapse Frontend

4.1.8 Verify the Setup Configuration

In the Measurement Organizer window,

Right click Setup, select Properties, a popup window will open.

Select the Measurement Control tab.

Under System, the Max. Frequency Range should be set to Auto.

Select the Environment Settings tab.

The Medium is Air.

Make the necessary measurements for pressure and temperature and enter the values (degrees C and hPa).

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Close the Setup window.

4.1.9 Verify that the CPB (Constant Percentage Bandwidth) Analyzer is enabled.

In the Measurement Organizer window,

Right click CPB Analyzer – select Properties – select Setup Tab

Filter Setting should show

Bandwidth - 1/1 Octave

Low Center Frequency - 31.5 Hz

Upper Center Frequency – 16K Hz

Acoustic Weighting – linear

Overall Bands should show

Weighting – L and A Bands

Average Update should show

Overloads – Accept

Averaging and Hold should show

Average Mode – Exponential

Exponential Averaging – 1s

Trigger Tab - All triggers should be set on Free Run

Spectra Tab

Autospectrum Group 1 – Measured

Cross-spectrum – Not Measured

Calculation Tab – Nothing to change

Close CPB Analyser properties window

4.2 Perform Microphone Calibration.

4.2.1 Preparation

In the Measurement Organizer Window, Expand the CPB Analyzer heading.

Expand the Group 1 heading.

Start Measurement

F5 or Measurement Start

4.2.2 Calibrate microphone

Place the microphone in the calibrator.

In the autospectrum plot window, place the Y-cursor on the calibration frequency with a left click.

In the Measurement Organiser window, under the signal heading, right click, select Properties and a signal window will pop up, select the Channel tab.

Verify the microphone sensitivity.

Verify the Input is set to Direct.

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Set the Max Peak Input for the calibration level.

If there is an overload on any signal, select a higher Max Peak Input level and restart the measurement.

Change the Gain Adjust until the Y value on the autospectrum plot window reads correctly.

Repeat 4.2.2 for each signal

4.2.3 Change to Group 2

Stop the measurement

Stop Button or F6

In the Measurement Organiser window, right click CPB Analyzer, select Select Groups. Include Group 2 only.

Activate the template

Measurement → Activate Template or F2

In the autospectrum plot window, move the cursor above the plot until it changes to a down arrow.

Right click and an information window will pop up.

In the Signal box, select the correct input signal

Right click on the next window, the information window will change, select the correct input signal, repeat for all windows.

Close the popup window

Start the Measurement

F5 or Measurement Start

Repeat 4.2.2 for the signals in Group 2.

4.2.4 Change to Group 1

In the Measurement Organiser window, right click CPB Analyzer, select Select Groups. Include Group 1 only.

Activate the template

Measurement → Activate Template or F2

In the autospectrum plot window, move the cursor above the plot until it changes to a down arrow.

Right click and an information window will pop up.

In the Signal box, select the correct input signal

Right click on the next window, the information window will change, select the correct input signal, repeat for all windows.

Close the popup window.

4.3. Perform Sound Power Measurements

4.3.1 Prepare the Excel data spreadsheet

Start Excel

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Click the desktop icon or Start -> Microsoft Excel
Open the file 'F:\Generic Sound Power.xls'
Save the file in the 'C:\Data\' directory with the test name.

4.3.2 Prepare the Pulse system

Set Averaging to Linear
Switch to the Pulse window.
In the Measurement Organiser window,
Right click CPB Analyzer – select Properties – select Setup Tab
Averaging and Hold should show
Average Mode – Linear
Linear Averaging – 60s
Close CPB Analyzer properties window
With the test article operating, find the appropriate input range for the selected group.
In the Measurement Organiser window,
Expand CPB Analyzer.
Right click the Group heading, select Properties, a pop-up window will appear.
Select the Channel Tab.
Select the appropriate Max Peak Input value.

4.3.3 Make the Measurement

Start the measurement
F5 or Measurement Start
If there is an overload on any signal, select a higher Max Peak Input level and restart the measurement.
F6 or Measurement Stop
F5 or Measurement Start
Close the Group Properties window

Wait for the measurement to complete

4.3.4 Save the Measurement

Click the green floppy disk button or F7
Make a note with the measurement number, microphone position number, and group number.

4.3.5 Copy the data to the Excel spreadsheet

Open the Display Organiser window.
Click the Toggle Display button, Organiser -> Display, or Ctrl 3
Expand the Display Group
Repeat the following for each signal
Right click on the menu header for the signal
Select copy

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Switch to the Excel window
Switch to 'Power Raw Data' sheet
In the column under the appropriate microphone heading, paste into Row 3.
Repeat for each signal
Save the Excel file

4.3.6 Change to Group 2

Switch to the Pulse window.
In the Measurement Organiser window, right click CPB Analyzer, select Select Groups. Include Group 2 only.
Activate the template
 Activate Template button, Measurement → Activate Template, or F2
In the autospectrum plot window, move the cursor above the plot until it changes to a down arrow.
Right click and an information window will pop up.
In the Signal box, select the correct input signal
Right click on the next window, the information window will change, select the correct input signal, repeat for all windows.
Close the popup window.
With the test article operating, find the appropriate input range for the selected group.
In the Measurement Organiser window,
Expand CPB Analyzer.
Right click the Group heading, select Properties, a pop-up window will appear.
Select the Channel Tab.
Select the appropriate Max Peak Input value.

4.3.7 Make the Measurement

Start the measurement
 F5 or Measurement Start
If there is an overload on any signal, select a higher Max Peak Input level and restart the measurement.
 F6 or Measurement Stop
 F5 or Measurement Start
Close the Group Properties window

4.3.8 Save the Measurement

Click the green floppy disk button or F7
Make a note with the measurement number, microphone position number, and group number.

4.3.9 Copy the data to the Excel spreadsheet

When the measurement is complete, open the Display Organiser window.

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Click the Toggle Display button, Organiser → Display, or Ctrl 3
Expand the Display Group
Repeat the following for each signal
Right click on the menu item for the signal
Select copy
Switch to the Excel window
Switch to 'Power Raw Data' sheet
Under the appropriate microphone heading, paste into Row 3.
Repeat for each signal
Save the Excel file

4.3.10 Repeat the measurement for the second set of 10 locations.

Rotate the test article 180 degrees.
In the Measurement Organiser window, right click CPB Analyzer, select Select Groups. Include Group 1 only.
Display Group 1 autospectrum plot windows
Activate the template
Measurement → Activate Template or F2
In the autospectrum plot window, move the cursor above the plot until it changes to a down arrow.
Right click and an information window will pop up.
In the Signal box, select the correct input signal
Right click on the next window, the information window will change, select the correct input signal, repeat for all windows.
Close the popup window
Repeat Sections 4.3.3 – 4.3.7 for measurements 11-20.

4.3.11 Noise Floor Measurements.

With the test article not operating,
In the Measurement Organiser window, right click CPB Analyzer, select Select Groups. Include Group 1 only.
Display Group 1 autospectrum plot windows
Activate the template
Measurement → Activate Template or F2
In the autospectrum plot window, move the cursor above the plot until it changes to a down arrow.
Right click and an information window will pop up.
In the Signal box, select the correct input signal
Right click on the next window, the information window will change, select the correct input signal, repeat for all windows.
Close the popup window

4.3.12 Make the Measurement

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Start the measurement
F5 or Measurement Start
Wait for the measurement to complete

4.3.13 Save the Measurement

Click the green floppy disk button or F7
Make a note with the measurement number, microphone position number, and group number.

4.3.14 Copy the data to the Excel spreadsheet

Open the Display Organiser window.
Click the Toggle Display button, Organiser → Display, or Ctrl 3
Expand the Display Group
Repeat the following for each signal
Right click on the menu header for the signal
Select copy
Switch to the Excel window
Switch to 'Power Noise Floor' sheet
In the column under the appropriate microphone heading, paste into Row 3.
Repeat for each signal
Save the Excel file

4.3.15 Change to Group 2

Switch to the Pulse window.
In the Measurement Organiser window, right click CPB Analyzer, select Select Groups. Include Group 2 only.
Activate the template
Activate Template button, Measurement → Activate Template, or F2
In the autospectrum plot window, move the cursor above the plot until it changes to a down arrow.
Right click and an information window will pop up.
In the Signal box, select the correct input signal
Right click on the next window, the information window will change, select the correct input signal, repeat for all windows.
Close the popup window.
With the test article operating, find the appropriate input range for the selected group.
In the Measurement Organiser window,
Expand CPB Analyzer.
Right click the Group heading, select Properties, a pop-up window will appear.
Select the Channel Tab.
Select the appropriate Max Peak Input value.

4.3.16 Make the Measurement

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Start the measurement

F5 or Measurement Start

4.3.17 Save the Measurement

Click the green floppy disk button or F7

Make a note with the measurement number, microphone position number, and group number.

4.3.18 Copy the data to the Excel spreadsheet

When the measurement is complete, open the Display Organiser window.

Click the Toggle Display button, Organiser → Display, or Ctrl 3

Expand the Display Group

Repeat the following for each signal

Right click on the menu item for the signal

Select copy

Switch to the Excel window

Switch to 'Power Noise Floor' sheet

Under the appropriate microphone heading, paste into Row 3.

Repeat for each signal

Save the Excel file

5.0 Sound Pressure Testing using the Pulse System

Note: If the sound pressure testing is performed after sound power testing, Sections 5.1.1 through 5.1.9 have already been accomplished and should be skipped.

5.1 Pulse Preparation

5.1.1 Start the Pulse software

Double click the Pulse icon

5.1.2 Open the generic sound power project.

Open the file 'F:\Generic Sound Power.pls'

File → Open

5.1.3 Save the project under a new name.

Save the file in the 'C:\Data\' directory with the test name.

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File -> Save As

5.1.4 **Verify that the hardware is responding.**

Open the Configuration Organiser window.

Click the Toggle Configuration button, Organiser -> Configuration, or Ctrl 1

All 4 boards should have a corresponding heading in the menu.

Close the Configuration Organiser window.

5.1.5 **Verify the Autospectrum signal functions.**

Open the Function Organizer window.

Click the Toggle Function button, Organiser -> Function, or Ctrl 3

Verify that the menu shows Autospectrum for signals 1-10.

Close the Function Organizer window.

5.1.6 **Open the Measurement Organiser window.**

Click the Toggle Measurement button, Organiser -> Measurement, or Ctrl 2

5.1.7 **Verify that the Groups and Signals are all present under the Frontend**

In the Measurement Organiser window,

Expand Frontend, Expand Signals

Should show 12 signals

Expand Groups

Should show

Group 1 with signals 1-5

Group 2 with signals 6-10

Group 3 with signal 11

Collapse Frontend

5.1.8 **Verify the Setup Configuration**

In the Measurement Organizer window,

Right click Setup, select Properties, a popup window will open.

Select the Measurement Control tab.

Under System, the Max. Frequency Range should be set to Auto.

Select the Environment Settings tab.

The Medium is Air.

Make the necessary measurements for pressure and temperature and enter the values (degrees C and hPa).

Close the Setup window.

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5.1.9 Verify that the CPB (Constant Percentage Bandwidth) Analyzer is enabled.

In the Measurement Organizer window,
Right click CPB Analyzer – select Properties – select Setup Tab
Filter Setting should show
Bandwidth - 1/1 Octave
Low Center Frequency - 31.5 Hz
Upper Center Frequency – 16K Hz
Acoustic Weighting – linear
Overall Bands should show
Weighting – L and A Bands
Average Update should show
Overloads – Accept
Averaging and Hold should show
Average Mode – Exponential
Exponential Averaging – 1s
Trigger Tab - All triggers should be set on Free Run
Spectra Tab
Autospectrum Group 1 – Measured
Cross-spectrum – Not Measured
Calculation Tab – Nothing to change
Close CPB Analyser properties window

5.1.10 Change to Group 3

In the Measurement Organiser window, right click CPB Analyzer, select Select Groups. Include Group 3 only.
Activate the template
Measurement → Activate Template or F2
In the autospectrum plot window, move the cursor above the plot until it changes to a down arrow.
Right click and an information window will pop up.
In the Signal box, select signal 11.
Close the popup window

5.2 Perform Microphone Calibration.

5.2.1 Preparation

In the Measurement Organizer Window, Expand the CPB Analyzer heading.
Expand the Group 3 heading.
Start Measurement
F5 or Measurement Start

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5.2.2 Calibrate microphone

Place the microphone in the calibrator.

In the autospectrum plot window, place the Y-cursor on the calibration frequency with a left click.

In the Measurement Organiser window, under the signal heading, right click, select Properties and a signal window will pop up, select the Channel tab.

Verify the microphone sensitivity.

Verify the Input is set to Direct.

Set the Max Peak Input for the calibration level.

If there is an overload on any signal, select a higher Max Peak Input level and restart the measurement.

Change the Gain Adjust until the Y value on the autospectrum plot window reads correctly.

5.3. Perform Sound Pressure Measurements

Note: If the sound pressure testing is performed after sound power testing, Section 5.3.1 has already been accomplished and should be skipped.

5.3.1 Prepare the Excel data spreadsheet

Start Excel

Click the desktop icon or Start → Microsoft Excel

Open the file 'F:\Generic Sound Power.xls'

Save the file in the 'C:\Data\' directory with the test name.

5.3.2 Prepare the Pulse system

Set Averaging to Linear

Switch to the Pulse window.

In the Measurement Organiser window,

Right click CPB Analyzer – select Properties – select Setup Tab

Averaging and Hold should show

Average Mode – Linear

Linear Averaging – 60s

Close CPB Analyzer properties window

With the test article operating, find the appropriate input range for the selected group.

In the Measurement Organiser window,

Expand CPB Analyzer.

Right click the Group heading, select Properties, a pop-up window will appear.

Select the Channel Tab.

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Select the appropriate Max Peak Input value.

5.3.3 Make the Measurement

Start the measurement

F5 or Measurement Start

If there is an overload on any signal, select a higher Max Peak Input level and restart the measurement.

F6 or Measurement Stop

F5 or Measurement Start

Close the Group Properties window

Wait for the measurement to complete

5.3.4 Save the Measurement

Click the green floppy disk button or F7

Make a note with the measurement number and the microphone location.

5.3.5 Copy the data to the Excel spreadsheet

Open the Display Organiser window.

Click the Toggle Display button, Organiser → Display, or Ctrl 3

Expand the Display Group

Right click on the menu header for the signal

Select copy

Switch to the Excel window

Switch to 'Pressure Raw Data' sheet

In the column under the appropriate microphone heading, paste into Row 3.

Save the Excel file

5.3.6 Measure the other sides of the test article.

Repeat sections 5.3.3 through 5.3.5 for each of the locations required for the test article.